UNITED STATES PATENT AND TRADEMARK OFFICE

h'A

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,952	06/27/2005	Tetsuhiko Takahashi	1141/74722	3793

23432 7590 06/27/2007
COOPER & DUNHAM, LLP
1185 AVENUE OF THE AMERICAS
NEW YORK, NY 10036

EXAMINER	
FETZNER, TIFFANY A	
ART UNIT	**PAPER NUMBER**
2859	
MAIL DATE	**DELIVERY MODE**
06/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/540,952	TAKAHASHI ET AL.
	Examiner	Art Unit
	Tiffany A. Fetzner	2859

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 March 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 June 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED Final ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 06/27/2005 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the examiner has considered the information disclosure statement. The initialed and dated information disclosure statement (IDS) submitted on 06/27/2005 is of record, and was previously attached to the Office action of November 17th 2006.

Drawings

3. The examiner approves the drawing corrections to **figure 1**, which were submitted on **March 21st 2007**.

Response to Arguments

4. Applicant's arguments filed March 21st 2007 have been fully considered but they are **not persuasive**. Applicant argues that the examiner has applied reception/response prior art against the claims. However the applied prior art of **Vasanawala et al.,** US patent 6,307,368 B1 is specifically directed to controlling the "excitation" (i.e. the transmitted pulses) via phase and frequency in order to control the overall resulting image response received. Therefore applicant's argument is not persuasive since controlling the phase of the excitation pulses applied is irradiation phase control of the applied RF magnetic field." Therefore the original rejections are maintained and made final. Examples of the excitation/irradiation phase and frequency control are found in numerous locations of the **Vasanawala et al.,** reference, and comprise the following: col. 2 lines 11-15; col. 2 lines 60-67; col. 3 lines 5-10; col. 10 lines 60-63 and col. 13 lines 4-15 where the 0-180-180-0 phase cycle of the excitation pulse is explained and controlled. Further examples of how reversing the RF pulse after the temporal applied center of the excitation phase is shown in the italicized more in depth explanation, set forth in the final rejection of amended claim 1 below.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. **Amended Claims 1-13** are **Finally** rejected under **35 U.S.C. 102(b)** as being anticipated by **Vasanawala et al.,** US patent 6,307,368 B1

7. With respect to **Amended Claim 1**, **Vasanawala et al.,** teaches and shows "A magnetic resonance imaging apparatus" [See figures 1a and 2; col. 1 lines 9-65] "comprising **RF** transmitting means for applying an RF magnetic field to a subject placed in a static magnetic field" [See transmitter 24 of figure 2], "an RF irradiation control means for controlling irradiation phase of the RF magnetic field" [See computer 20, RF coils 26, 14, and the gradient coils of figures 1a and 2], "**RF** receiving means for detecting nuclear magnetic resonance signals generated from the subject" [See receiver 28 of figure 2], "a control means for controlling the **RF** transmitting means, the RF irradiation control means and the **RF** receiving means" [See computer component 20], "and an image formation means for reconstructing an image of the subject by using the nuclear magnetic resonance signals" [See the operating console, the CRT and the computer 20 of figure 2], "wherein the RF irradiation control means" (i.e. computer 20 and gradient amplifier 22) "controls RF irradiation so that the RF pulse should be applied with a phase of the second half of the RF pulse waveform after the **temporal** center thereof different by 180 degrees from the phase of the first half of the RF pulse waveform" *[See the excitation pulse waveforms shown in figure 3, where the phase of the RF pulse applied reverses itself once the temporal center of the RF pulse is reached. Additionally the examiner notes that **Vasanawala et al.,** teaches that the response signal depends on the "excitation flip angle" [See col. 4 lines 63-64 and the flip angle with the phase routine of 0-180-180-0 of col. 12 lines 40-48, is an excitation routine producing figure 16a where the applied phase which reverses itself halfway through the temporal center of the sequence, 10 180 degrees out of phase with the first*

*half of the sequence. The resulting phase responses of the detected signals in figures 4a, 4b; 23a and 31b where the phase of the 1st half of the RF pulse waveform from –200→0 is the opposite of (i.e. 180 degrees out of phase from) the 0→200 2nd half of the RF pulse waveform, also support the examiner's position that the RF excitation pulses applied in **Vasanawala et al.,** reverse themselves, (i.e. are 180 degrees opposite one another) after the temporal center of the applied pulse. See also figure 3.*]

8. With respect to **Amended Claim 2, Vasanawala et al.,** teaches and shows that "the **RF** transmitting means is provided with a multiple array **RF** transmitting coil comprising multiple **RF** coils of different sensitivity profiles" [See figures 1a through figure 2, where coil 14 is comprised of at least a two coil array with opposite sensitivities, and also figure 2 where transmitter 24 controls both of the RF coils 26 which also comprise at least a two coil transmitting array with opposite or inverted sensitivity profiles. See also col. 1 lines 9-65], "and the RF irradiation control means" (i.e. [See computer 20, RF coils 26, 14, and the gradient coils of figures 1a and 2]), "performs such phase control for a part of the multiple **RF** coils that the phase of the second half of the RF pulse waveform after the **temporal** center thereof should be different by 180 degrees from the phase of the first half of the RF pulse waveform". [See the pulse waveforms shown in figures 4a, 4b; 16a, 23a and 31b where the phase of the 1st half of the RF pulse waveform from –200→0 is the opposite of (i.e. 180 degrees out of phase from) the 0→200 2nd half of the RF pulse waveform.] The same reasons for rejection, that apply to **claim 1** also apply to **claim 2** and need not be reiterated.

9. With respect to **Amended Claim 3, Vasanawala et al.,** shows that "the multiple array **RF** transmitting coil" [See figures 1a, 2] "is provided with a **RF** loop coil" (i.e. RF coil 26 of figure 2, or the RF gradient coils which do not have a component number in figure 2, both meet this limitation. The examiner notes that in figure 1 the unlabeled gradient coils are loop wound on the rectangular loop cylinder 12] "and at least one **RF** differential coil" (i.e. the saddle RF coil 14 of figure 1a], "the **RF** differential coil" (i.e. RF saddle coil 14) "is provided with multiple **RF** subloop coils" [See the structure of component 14 in figure 1a], "the multiple **RF** subloop coils and the loop coil have a common central axis" [See figures 1a and figure 2 which show this limitation.], "the **RF**

subloop coils are plane-symmetrically disposed around" (i.e. within the circumscribed volume defined by) "the loop coil" (i.e. inside the rectangular loop cylinder) "as the center" of the coil structure. (i.e. see figure 1a where saddle coil 14 is a central plane-symmetrically disposed coil structure) "and the **RF** subloop coils" (i.e. the x-y plane arcing loops on the right and left hand side of the top half of saddle coil 14 which are connected by the linear z-portion, **or** the x-y plane arcing loops on the right and left hand side of the bottom half of saddle coil 14 which are connected by the linear z-portion) "constituting the same **RF** differential coil" (i.e. either the top/upper or the lower/bottom saddle coil 14) "are connected so that currents should flow through a pair of plane-symmetrically disposed **RF** subloop coils in different directions". [See figure 1a. The examiner notes that because the right and left hand sides of either one of the upper or the lower half of the saddle coil 14 is mirror-symmetric, as is the field of view within the RF saddle coil 14 that the currents in the right and left hand sides as well as the upper and lower halves, of the overall saddle coil 14 are intrinsically flowing is opposite directions, due to the coil configuration itself.] The same reasons for rejection, that apply to **claims 1, 2** also apply to **claim 3** and need not be reiterated.

10. With respect to **Amended Claim 4**, **Vasanawala et al.,** shows that "the **RF** differential coil" (i.e. saddle coil 14) "is provided with a primary **RF** differential coil" (i.e. the top upper half of coil 14) "and a secondary **RF** differential coil" (i.e. the lower bottom half of coil 14), "the **RF** subloop coils of the primary **RF** differential coil" (i.e. the x-y plane arcing loops on the right and left hand side of the top half of saddle coil 14, and its z-plane linear regions) "are disposed so that the **RF** loop coil" (i.e. the unlabeled RF gradient rectangularly cylindrical loop coil components on cylinder 12 of figure 1a) "should locate" (i.e. contain an imaging field of view, from which an image may be formed) "between the **RF** subloop coils of the primary **RF** differential coil" [See the upper half of the homogeneous region within the volume defined by the upper saddle coil 14] , "and the **RF** subloop coils of the secondary **RF** differential coil" (i.e. the x-y plane arcing loops on the right and left hand side of the bottom half of saddle coil 14, and its z-plane linear regions) "are disposed so that the **RF** loop coil" (i.e. the unlabeled RF gradient rectangularly cylindrical loop coil components on cylinder 12 of figure 1a)

"and the **RF** subloop coils of the primary **RF** differential coil" (i.e. the x-y plane arcing loops on the right and left hand side of the top half of saddle coil 14, and its z-plane linear regions) "should locate" (i.e. contain an imaging field of view, from which an image may be formed) "between the **RF** subloop coils of the secondary **RF** differential coil". (i.e. the x-y plane arcing loops on the right and left hand side of the bottom half of saddle coil 14, and its z-plane linear regions). " [See the lower half of the homogeneous region within the volume defined by the lower saddle coil 14 of figure 1a.] The same reasons for rejection, that apply to **claims 1, 2, 3** also apply to **claim 4** and need not be reiterated.

11. With respect to **Amended Claim 5**, **Vasanawala et al.,** shows that "the **RF** transmitting means" (i.e. component 24 of figure 2) "is provided with, as **RF** transmitting coils, a first multiple array **RF** transmitting coil" (i.e saddle coil 14 of figure 1a which is comprised of an upper saddle coil 14 and a lower saddle coil 14; **or** from the combination of figures 1a and figure 2, a structure where the upper saddle coil 14 is represented as upper RF coil 26; and the lower saddle coil 14 of figure 1a is represented as lower RF coil 26 in figure 2;) "comprising a first **RF** loop coil and at least one differential coil having a common central axis" because the paired RF coils 26 and 14 of figures 1a and figure 2 are both loop shaped coils which provide either a saddle (i.e. coil 14), or a rectangular loop magnetic field (i.e. RF coil 26) differential, to produce a homogeneous magnetic region between the upper and lower coil components along a common axis. [See figures 1a and figure 2]. **Vasanawala et al.,** also shows "a second multiple array **RF** transmitting coil" (i.e. the paired gradient coils which are wound on cylinder 12 of figure 1a through 1d which transmit RF gradient pulses; **or** the RF transmitting gradient coils identified in figure 2, without a component number. The examiner notes that gradient coils are intrinsically differential coils, because a magnetic gradient is by definition a specific magnetic differential that is applied in a specific direction. Because figure 2 shows the gradient coils as rectangular loop coils, **Vasanawala et al.,** shows "a second multiple array **RF** transmitting coil comprising a second **RF** loop coil and at least one **RF** differential coil having a common central axis" [See figure 2, with respect to the pair of rectangular loop shaped gradient coils, which

transmit a differential gradient magnetic field, across 'a common central axis'.] Additionally from figure 2 **Vasanawala et al.,** shows that the central axes of the first and second multiple array <u>**RF**</u> transmitting coil are perpendicular to each other." [See figure 2 where the common axes of components 26, and the gradient coil are shown to be "perpendicular to each other." The same reasons for rejection that apply to **claims 1**, **2** also apply to **claim 5** and need not be reiterated.

12. With respect to **Amended Claim 6**, **Vasanawala et al.,** shows that "the <u>**RF**</u> loop coil" (i.e. RF coil component 26 or the gradient coils of figure 2) "comprises plane-symmetrically disposed" [See figure 2] "multiple" (i.e. at least two) "<u>**RF**</u> loop coils" (i.e. there are two RF loop coils 26 shown in figure 2, which are 'plane-symmetrically disposed" on either side of a common axis, and two gradient coils shown in figure 2, which are also 'plane-symmetrically disposed" on either side of a common axis.) [See figure 2]. The same reasons for rejection that apply to **claims 1**, **2,** and **3** also apply to **claim 6** and need not be reiterated.

13. With respect to **Amended Claim 7**, **Vasanawala et al.,** shows that "wherein the RF irradiation control means" (i.e. computer 20, gradient amplifier 22 and transmitter 24 combined) "performs such phase control for the <u>**RF**</u> differential coil among the multiple <u>**RF**</u> coils that the phase of the second half of the RF pulse waveform after the <u>**temporal**</u> center thereof should be different by 180 degree from the phase of the first half of the RF pulse waveform" [See the Gy and Gz gradients of figure 3, and figures 4a, 4b, 16a, 23a, and 31b]. The same reasons for rejection that apply to **claims 1**, **2,** and **3** also apply to **claim 7** and need not be reiterated.

14. With respect to **Amended Claim 8**, **Vasanawala et al.,** shows and teaches that "the RF irradiation control means (i.e. computer 20, the RF transmitter 24 and the gradient amplifier 22) "performs such phase control for the <u>**RF**</u> differential coil that the phase should be inverse in two times of measurement, and the image formation means adds nuclear magnetic resonance signals obtained by two times of the measurement to reconstruct one image." [See figures 16a→23a, 31b, 4a, 4b, 8a, 8b, and 10a → 11d; **col. 11 line 6 → col. 17 line 49**; where all of the different variations and permutations of how to combine the different phases and k-space data contrasts (i.e. the different

sensitivities/profiles) image sets acquired concurrently to produce constructive or destructive interference in a final resulting image, from the multiple measurements and data image sets is taught in detail. See also the NMR images of figures 5, 12a, 12b, 13a→13e, 14, 19, 25→29; and col. 5 line 55 through col.7 line 49.] The same reasons for rejection that applies to **claims 1**, **2, 3,** and **7** also apply to **claim 8** and need not be reiterated.

15. With respect to **Amended Claim 9**, **Vasanawala et al.,** shows that "wherein the control means" (I.e. computer 20 and gradient amplifier 22 of figure 2) "performs selective excitation for the slice direction" for the duration of time in which a detectable signal is to be received "upon" the termination of the "excitation by application of the RF magnetic field." [See figures 2 and 3 in combination, the Gx timing line in figure 3 is the slice direction.] The same reasons for rejection that apply to **claim 1**, also apply to **claim 9** and need not be reiterated.

16. With respect to **Amended Claim 10**, **Vasanawala et al.,** shows that "the control means " (I.e. computer 20 and gradient amplifier 22 of figure 2) "performs selective excitation for the phase encoding direction or frequency encoding direction upon excitation by application of the RF magnetic field." [See figures 2 and 3 in combination, the Gy and Gz timing lines in figure 3 represent the phase and frequency directions.] The same reasons for rejection that apply to **claim 1**, also apply to **claim 10** and need not be reiterated.

17. With respect to **Amended Claim 11**, **Vasanawala et al.,** shows that "the multiple array **RF** transmitting coil is used also as an RF receiving coil of the receiving means. [See figure 2 which shows that the same coils are used to transmit and receive.] The same reasons for rejection that apply to **claims 1**, **2,** and **3** also apply to **claim 11** and need not be reiterated.

18. With respect to **Amended Claim 12**, **Vasanawala et al.,** shows and teaches that "the control means" (I.e. computer 20 and gradient amplifier 22 of figure 2) "performs imaging with thinning out the phase encoding" [See col. 3 lines 1-16; col. 5 lines 56-63; col. 7 lines 17-49, where alternating, interleaved, or odd/even phase encoding to reduce the number of phase encodes for each set of data is utilized.], "and when an

image is reconstructed by using nuclear magnetic resonance signals detected by each of the coils of the multiple array RF transmitting coil, the image formation means performs an anti-aliasing operation" (i.e correctly separating the water and fat pixels) [see col. 7 lines 17-49; col. 8 line 38 through col. 9 line 46]; "by using a sensitivity profile" (i.e. the contrast sensitivity of the pass band) col. 2 line 3; col. 2 line 9 through col. 3 line 11; col. 4 line 43 through col. 5 line 12; col. 6 line 25 through col. 7 line 49] "of each of the coils constituting the multiple array RF transmitting coil" [See figures 1a and 2 in combination with the citations already provided in this claim, since the obtained signals come from each of the RF coils present.] The same reasons for rejection that apply to **claims 1**, **2, 3** and **11** also apply to **claim 12** and need not be reiterated.

19. With respect to **Amended Claim 13**, **Vasanawala et al.,** shows and teaches that "the image formation means" (i.e. computer 20, the CRT and the operating console) "composes images reconstructed by using nuclear magnetic resonance signals detected by each of the coils of the multiple array RF transmitting coil to produce one image." [See col. 1 lines 9-24; figures 5, 12a, 12b, 13a→13e, 14, 19, and 25→29.] The same reasons for rejection that apply to **claims 1**, **2, 3** and **11** also apply to **claim 13** and need not be reiterated.

20. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

21. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

23. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(571) 273-8300**.

24. Information regarding the status of an application may be obtained from the Patent Application information Retrieval (PAIR) system Status information for published applications may be obtained from either Private PMR or Public PMR. Status information for unpublished applications is available through Private PMR only. For more information about the PMR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PMR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Tiffany A. Fetzner
TAF
June 22nd 2007

Diego Gutierrez
Supervisory Patent Examiner
Technology Center 2800